

AUSTENITIC STAINLESS STEEL HAVING HIGH PROPERTIES

1. Field of the Invention

The present invention relates to an austenitic stainless steel having high strength, high resistance to corrosion and a very good structural stability.

2. Background of the Invention

For the manufacture of equipment intended in particular for smoke depolluting installations, oil well platforms, the chemical industry, the paper pulp industry, there are employed austenitic or superaustenitic stainless steels having high strength and a high resistance to corrosion. These stainless steels generally contain high proportions of nitrogen and molybdenum. Such steels have been disclosed in particular in two European patents: EP-A-0,438,992 and EP-A-0,342,574 and in the French patent application FR-93-06468. But these steels have the drawback of a certain incompatibility between a good behaviour with respect to corrosion and a good structural stability. Consequently, there is for example a certain difficulty in conciliating the operations for manufacturing equipment, such as welding or hot forming, and a very high resistance to corrosion of all of the parts of this equipment.

Austenitic stainless steels having high strength and high resistance to corrosion known in the art have another drawback in that they cannot be used in the form of massive parts. Indeed, in the course of the cooling of the parts, the instability of the structure causes intermetallic precipitations which very markedly adversely affect the resistance to corrosion and the mechanical properties of the steel.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an austenitic stainless steel having high mechanical properties, a very high resistance to corrosion in a chlorinated medium, and a very good structural stability.

For this purpose, the invention provides an austenitic stainless steel having high mechanical properties, high resistance to corrosion, and a high structural stability, the chemical composition of which comprises, by weight:

$$0.35\% \leq N \leq 0.8\%$$

$$1\% \leq W \leq 5\%$$

and at the most 6% Mn.

Preferably, the chemical composition of the steel comprises by weight:

$$23\% \leq Cr \leq 28\%$$

$$15\% \leq Ni \leq 28\%$$

$$0.5\% \leq Mn \leq 6\%$$

$$0\% \leq Cu \leq 5\%$$

$$0\% \leq C \leq 0.06\%$$

$$0\% \leq Si \leq 1\%$$

$$0\% \leq Nb \leq 0.5\%$$

$$0\% \leq V \leq 0.5\%$$

$$0\% \leq Al \leq 0.1\%$$

$$3\% \leq Mo \leq 8\%$$

$$0.35\% \leq N \leq 0.8\%$$

$1\% \leq W \leq 5\%$ the remainder consisting of iron and impurities related to the preparation. Still more preferably, the chemical composition of the steel comprises by weight:

$$23\% \leq Cr \leq 26\%$$

$$21\% \leq Ni \leq 23\%$$

$$2\% \leq Mn \leq 3.5\%$$

$$1\% \leq Cu \leq 2\%$$

$$0\% \leq C \leq 0.03\%$$

$$0\% \leq Si \leq 0.4\%$$

$$0\% \leq Nb \leq 0.5\%$$

$$0\% \leq Al \leq 0.1\%$$

$$4.5\% \leq Mo \leq 6.5\%$$

$$0.4\% \leq N \leq 0.55\%$$

$$2\% \leq W \leq 3.5\%$$

the remainder consisting of iron and impurities related to the preparation.

Preferably, the chemical composition of the steel according to the invention satisfies the following formula:

$$CP = 20 \times \%Cr + 0.3 \times \%Ni + 30 \times \%Si + 40 \times \%Mo + 5 \times \%W + 10 \times \%Mn + 50 \times \%C - 200 \times \%N < 710$$

which ensures that the kinetics of the precipitation of the intermetallic phases will be as slow as possible.

Moreover, in order to obtain the best possible resistance to corrosion, the chemical composition of the steel must correspond to the following:

$$PREN_W =$$

$$Cr + 3.3 \times \%Mo + 16 \times \%N + 1.7 \times \%W > 47.$$

Lastly, in order to obtain very high mechanical properties, the chemical composition of the steel must preferably satisfy the relation: $113 + 16 (\%Mo + 0.7\%W) + 525\%N > 420$.

According to the invention, this steel may be used for manufacturing massive parts. It may also be used for manufacturing equipment for massive oil platforms or for manufacturing equipment for chemical works, paper pulp works, depolluting installations, or for manufacturing containers for transporting corrosive products, or lastly for manufacturing ship hulls. This steel may also be employed for manufacturing ply or clad sheets.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The invention will now be described in detail in a non-limitative manner.

Those skilled in the art know austenitic stainless steels which are iron-base alloys, have a high chromium and nickel content and have a naturally austenitic structure in the solid state substantially at any temperature. For most of these steels, the structure is not 100% austenitic at around the solidification point but becomes so as soon as the temperature drops. For some of these steels, termed superaustenitic steels, the structure is 100% austenitic upon solidification. These steels are considered to be known.

The inventors have noticed that, surprisingly, by simultaneously adding to these steels high contents of nitrogen: 0.35% by weight to 0.8% by weight, and preferably 0.4% to 0.55%, and of tungsten: 1% by weight to 5% by weight, and preferably 2% to 3.5%, there were obtained at once high mechanical properties, a very high resistance to corrosion in a chlorinated medium and a very good structural stability, i.e. a very slow kinetics of precipitation of intermetallic phases at elevated temperature.

A very good structural stability permits manufacturing massive parts, for example: thick sheets, thick tubes, forged parts, moulded parts or welded assemblies of which the mechanical properties and the behaviour with respect to